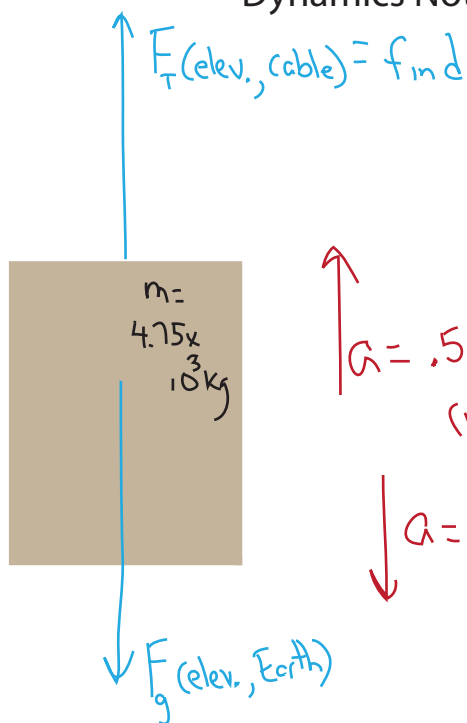


Dynamics Notes - example 3



$$\begin{aligned} \uparrow a &= .5 \times 10^{-2} \text{ g's} \\ &\quad (\text{max } F_T) \\ \downarrow a &= .5 \times 10^{-2} \text{ g's} \\ &\quad (\text{min } F_T) \end{aligned}$$

Theory/Strategy:

The maximum tension will occur when the elevator accelerates upwards because F_t must be greater than F_g . The minimum tension will occur when the acceleration is downwards because F_t will be less than F_g .

max F_T case
Known/ F_{ind}

$$\begin{aligned} m &= 4.75 \times 10^3 \text{ kg} \\ a &= .5 \times 10^{-2} \text{ g's} \xrightarrow{\text{conv.}} \frac{0.5 \times 10^{-2} \text{ g}}{1} \cdot \frac{9.8 \frac{\text{m}}{\text{s}^2}}{1 \text{ g}} = 4.9 \times 10^{-3} \frac{\text{m}}{\text{s}^2} \end{aligned}$$

$$F_T = f_{ind}$$

Eqn./Soln

$$\sum F = ma$$

$$+F_T - F_g = ma$$

$$F_T - mg = ma$$

$$F_T = mg + ma$$

$$F_T = m(g + a)$$

$$F_T = 4.75 \times 10^3 \text{ kg} (9.8 \frac{\text{m}}{\text{s}^2} + 4.9 \times 10^{-3} \frac{\text{m}}{\text{s}^2})$$

$$F_T = 4.68 \times 10^4 \text{ N}$$

min F_T case

Note: Since the only difference between the two cases is the direction of acceleration we can just change the direction of the acceleration in the equation we just found.

$$F_T = m(g - a)$$

$$F_T = 4.75 \times 10^3 \text{ kg} (9.8 \frac{\text{m}}{\text{s}^2} - 4.9 \times 10^{-3} \frac{\text{m}}{\text{s}^2})$$

$$F_T = 2.33 \times 10^4 \text{ N}$$

Response

$$\text{max } F_T = +4.68 \times 10^4 \text{ N}$$

$$\text{min } F_T = +4.63 \times 10^4 \text{ N}$$